

**“EFFECT OF BOWEN TECHNIQUE VERSUS MUSCLE
ENERGY TECHNIQUE ON ASYMPTOMATIC SUBJECTS WITH
HAMSTRING TIGHTNESS”.**

A Dissertation Submitted To

**THE TAMILNADU Dr .M.G.R. MEDICAL UNIVERSITY
CHENNAI**

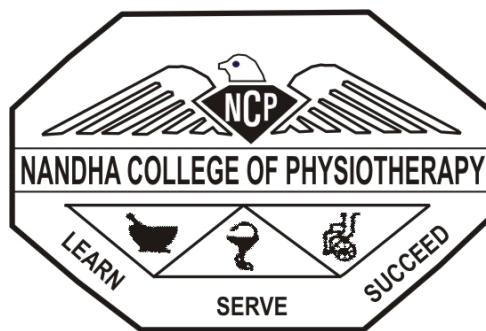
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MASTER OF THE PHYSIOTHERAPY DEGREE

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Under the guidance of

Prof. S.BENAZIRM.P.T (Sports) ,M.I.A.P

The Dissertation Submitted To

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CHENNAI**

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I wish him a great success in his dissertation work.

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PLACE : Erode

GUIDE SIGNATURE

DATE :

DECLARATION

I hereby and present my project work entitled “**EFFECT OF BOWEN TECHNIQUE VERSUS MUSCLE ENERGY TECHNIQUE ON ASYMPTOMATIC SUBJECTS WITH HAMSTRINGTIGHTNESS**”, is outcome of original research work was undertaken and carried out by me under the guidance of **Prof. S.BENAZIR, M.P.T, (SPORTS),MIAP**

To the best of my knowledge this dissertation has not been formed in any other basic for the award of any other degree, diploma, associateship, fellowship, preciously from any other medical university.

Reg.No.271650081

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I am very happy to express my heartfelt thanks to the **GOD** almighty giving me strength and wisdom in successfully completing this project work in an efficient manner.

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PREFACE

It was immense pleasure for me to present this project work on **“EFFECT OF BOWEN TECHNIQUE VERSUS MUSCLE ENERGY TECHNIQUE ON ASYMPTOMATIC SUBJECTS WITH HAMSTRINGTIGHTNESS”** because this opportunity made me learn a lot about this condition.

I have done this work with my best level by referring many Sports medicine books, manual therapy books, journals and websites. I have assessed and given treatment to patient to improve their condition. I believe this project work will prove to be very useful for the physiotherapists to give a better knowledge while assessing and treating hamstring tightness patients.

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CHAPTER-I

INTRODUCTION

The movement of the human body is caused by the muscular system. There are about 700 muscles attached to the bones of the skeletal system that help to make up half of the person's body weight roughly. Skeletal muscles are made up of contractile and non-contractile connective tissues. The characteristics of contractility and irritability are given by the contractile elements of the muscle.

The greatest measurable force that can be exerted by a muscle or muscle group to overcome resistance during single maximum effort is the muscle strength. The ability of a muscle to contract repeatedly against a load (resistance), produce and sustain tension, and resist fatigue over an extended period of time is the muscle endurance.

Hamstring muscle is located at the back of the thigh. This muscle starts in the gluteal region and courses through the back of the thigh and ends in the popliteal fossa. Three muscles together form the hamstring muscle. Biceps femoris, semiten dinosus muscle and semi membranous muscle. These muscles are responsible for the flexion of the knee joint as well as help in extension of the thigh.

The major aetiological factors in musculoskeletal injuries are considered to be due to muscle stiffness of the lower extremity and the consequential decrease in joint flexibility. The ability of the muscle to lengthen allowing one joint (or more than one joint) to move through the range of motion is due to the flexibility of the muscle. If a muscle has good flexibility it will allow muscle tissue to accommodate to imposed stress more easily and allows efficient and effective movement. If there is enhanced muscle flexibility it will assist in preventing or minimizing injuries and enhance performance of the muscle. The muscle which is found to be most prevalent for the tightness in the body is the hamstrings.

Worrel, et al. stated that a "lack of hamstring flexibility was the single most important characteristics of hamstring injuries in athletes". Tight hamstrings have been involved in lumbar spine dysfunction and shows strong positive correlation

between low back pain and reduced hamstring flexibility. Tightness of the muscle is a limiting factor for ideal physical performance as well as daily activities and an important intrinsic factor for sports injuries.

Muscle tightness –Muscles contract by neural stimulation to the motor units that are scattered among the muscles like little electric wires. Muscle fibers contract by sliding across each other to pull the joints closer together. Actin and Myosin, two of the muscle-contracting proteins, make these fibers stick together. However, prolonged neural stimulation of the muscle causes them to stay contracted, keeping the joint and surrounding tissues short and tight.

Muscle stiffness is when muscles feel tight and more difficult to move than usual. Most relevant cause of muscle stiffness is due to unused due to muscle pain and cramping.

Range of motion is very important in the case of muscle flexibility. Following factors affect flexibility of the joint. They are

Joint structure- there are several different types of joints in the human body. Some have a greater range of motion than others. Age and Gender-range of motion and flexibility naturally decreases as you get older.

Connective tissue- Deep connective tissue such as fascia and tendons can limit range of motion. These tissues differ in their ability to return to their original resting length (elasticity) and their tendency to keep a new and greater length after stretched (plasticity). Ligaments are not elastic, but can respond to stretching. Over time connective tissues lose water content and the collagen in ligaments and tendons can become thicker and less flexible.

Muscle bulk- Big muscles adversely affect range of motion. It may be difficult for very bulky athletes to complete certain stretches because their muscle mass gets in a way.

Proprioceptors - these are tiny sensors located inside muscle fibers that provide information about joint angle, muscle length and muscle tension. Careful, purposeful, slow stretching can ensure that these sensors don't trigger spasms or reflex actions that don't help build flexibility.

Bowen Technique - The Bowen technique or Bowen therapy is an alternative type of physical manipulation named after Australian Thomas Bowen. This technique works on the soft connective tissue (fascia) of the body. It can be used to treat musculoskeletal or related neurological problems including acute sports injuries and chronic or organic conditions. It is gentle and relaxing and does not use forceful manipulation. Bowen therapy is performed on the superficial and deep fascia. The fascia, or soft tissue, is the part of the connective tissue that envelops, separates and influences every organ and tissue in the body.

Muscle Energy Technique - Muscle energy techniques describes a broad class of manual therapy techniques directed at improving musculoskeletal function or joint function, and improving pain. Historically, the concept emerged as a form of osteopathic manipulative diagnosis and treatment in which the patient muscles are actively used on request, from a precisely controlled position, in a specific direction, and against a distinctly executed counterforce. It targets the soft tissue primarily and can be called as active muscular relaxation technique.

1.1 OPERATIONAL DEFINITIONS

1.1 (a) Flexibility

Flexibility is the ability to move a single joint or series of joints smoothly and easily through restricted pain free range of motion.

1.1 (b) Muscle tightness

It is when muscles feel tight and find it more difficult to move than usual, especially after rest or injury. Muscle contract by neural stimulation to the motor units that are scattered among the muscles like little electric wires. Muscle fibers contract by sliding across each other to pull the joints closer together.

1.1 (c) Active muscle relaxation technique (AMRT)

A type of body work used to relax overly active muscles and manage soft tissue pain. AMRT requires isometric contractions of either or overactive muscle, or its antagonist against resistance.

1.1 (d) Post isometric relaxation (PIR) technique

One kind of manual therapy technique consists of isometric tension followed by passive stretching. This technique is a kind muscle energy technique. The idea of post isometric relaxation is such that at the time of isometric contraction unaffected parts of the same muscle stretch pathologically affected parts. Post isometric stretching stimulates Golgi organ, which in turn additionally relax the affected muscles.

1.1 (e) Popliteal angle

The popliteal angle is an assessment of the tone of the hamstring muscles. It is done one leg at a time. Subject will be supine position on the plinth. Subject then flexes hip to 90. Subject then actively extends each knee in turn. Fulcrum of the goniometer will be placed over the lateral condyle of the knee joint and popliteal angle is measured. Using a goniometer, the popliteal angle was measured with the hip held at 90 degrees flexion to indicate hamstring muscle tightness. Normal popliteal angle is between the ages of 1 and 3 years, the mean angle was 6 degrees (range, 0-15). At age 4, the angle rose to 17 degrees in girls and 27 degrees in boys (range, 35-45).

1.1 (f) Sit And Reach Test

- ✓ This test involves sitting on the floor with legs stretched out straight ahead.
- ✓ Shoes should be removed and the soles of the feet are placed against the wall.
- ✓ Both knees should be locked and pressed flat to the floor.
- ✓ With the palm facing downward, the subject reaches forward along the measuring line as far as possible. Ensure that the hands remain at the same level.
- ✓ After some practice, the subject reaches out and holds that position for at least one-two seconds while the distance is recorded.

1.2 NEED FOR THE STUDY

- ✓ The purpose of this study was to investigate the effect of Bowen Technique versus Muscle Energy Technique on asymptomatic subjects with hamstring tightness.
- ✓ To understand about both Bowen and Muscle Energy Techniques.
- ✓ To find out the most effective technique for improving hamstring muscle tightness.

Hence I concluded to do my research on “Effect of Bowen Technique versus Muscle Energy Technique on asymptomatic subjects with hamstring tightness”.

1.3 AIM OF THE STUDY

To find out the effectiveness of Bowen Technique versus Muscle Energy Technique on asymptomatic subjects with hamstring tightness.

1.4 OBJECTIVES OF THE STUDY

- ✓ To have in depth knowledge about the muscle hamstring.
- ✓ To improve the hamstring flexibility in healthy individuals.
- ✓ To know about both Bowen and Muscle Energy Techniques.
- ✓ To find out the effectiveness of Bowen Technique versus Muscle Energy Technique on a asymptomatic subjects with hamstring tightness.

1.5 VARIABLES OF THE STUDY

1.5 (a) INDEPENDENT VARIABLES

- Bowen Technique.
- Muscle Energy Technique.

1.5 (b) DEPENDENT VARIABLES

- Goniometer (ROM)
- Sit and reach test

1.6 HYPOTHESIS

1.6 (a) NULL HYPOTHESIS

There is no significant improvement in the effect of Bowen Technique versus Muscle Energy Technique on asymptomatic subjects with hamstring tightness.

1.6 (b) ALTERNATE HYPOTHESIS

There is a significant difference in the effect of Bowen Technique versus Muscle Energy Technique on asymptomatic subjects with hamstring tightness.

1.7 ASSUMPTION

The study has been conducted assuming that Bowen technique versus Muscle Energy Technique on asymptomatic subjects with hamstring tightness will reduce the tightness of the hamstring muscle.

1.8 PROJECTED OUTCOME

Based on review of literature, it is expected that there will be significant improvement in Bowen Technique in hamstring muscle tightness individuals.

CHAPTER-II

REVIEW OF LITERATURE

1.Divya GPatel, Neeta J Vyas Megha S Sheth(2016)

Flexibility is the ability to move a single or series of joints smoothly and easily through an unrestricted, pain-free range of motion. Decreased hamstring flexibility is considered to be a predisposing factor for lower back pain and injury. The purpose of the study was to see the immediate effect of a single session of self-myofascial release on plantar aspect of foot, on hamstring and lumbar spine flexibility.

2.Saeid Izadkhah , Nasin Naseri , Nader Maarufi , Yashar Kocheili , Hashem Shabedin (2016)

Muscular shortness is one of the most common musculoskeletal impairments. It may occur as a result of trauma or even a sedentary life style and cause clinical symptoms. Hamstring muscle, due to its functional roles, is prone to injuries during physical activities. Research has shown that decreased hamstring muscle flexibility may lead to lower extremity injury. The goal of this study is to compare the effects of myofascial release (MFR) and muscle energy technique (MET) effects on hamstring muscle flexibility.

3.Puttergill,Jeff(2016)

Myofascial therapies are widely researched with regards to their effects on pain, disability and range of motion. The benefits of such therapies are attributed to the mechanical changes that myofascial therapies are proposed to have on the fascial and myofascial structures. Breakthrough imaging and laboratory techniques, have allowed the in vivo study of these structures, resulting in new hypotheses regarding the roles that connective tissues might play in proprioception.

4. Peeyoosha Nitsure¹, Neha Kothari(2015)

To evaluate the effect of Bowen Technique as an adjunct to the conventional physiotherapy treatment on Trapezitis in terms of pain, disability and cervical range of motion. Bowen technique is effective in reducing pain, improving ROM and reducing neck disability in patients with Acute Trapezitis.

5. Pramod K. Jagtap Shubhangi D. Mandale(2015)

Describes the steady Pressure to soft tissues to effect relaxation and normalize reflex Hamstring tightness is a major contributing factor for lower back pain, lumbar spine disorders and sports related injuries. Sub- occipital muscle inhibition technique activity.

6. Rahul Tanwar, Monika Moitra Manu Goyal(2014)

Plantar fasciitis is considered to be an overuse syndrome as it develops over time and is a result of repeated stress that exceeds the body's inherent capacity to repair and adapt which eventually leads to the failure of the ligaments, bones and muscles. To study the effectiveness of muscle energy technique to improve flexibility of gastro-soleus complex in plantar fasciitis.

7. Jesudas Mazumdar Jitendra Kumar Shriwas (2014)

The Hamstring muscles of the back thigh are found to be the most prevalent for tightness in the body. The purpose of this study is to compare effectiveness of Mulligan Traction Straight Leg Raise and Muscle Energy Technique methods in increasing range of motion and flexibility of knee joint.

8. Radhika Talapalli Megha Sandeep Sheth(2014)

To compare the effectiveness of Muscle energy technique (MET) and Post isometric relaxation (PIR) on hamstring flexibility in healthy young individuals with hamstring tightness. Muscle Energy technique is found to be more effective in decreasing hamstring tightness than post isometric relaxation in healthy young individuals.

9. Masters, Yashvant(2014)

The aim of this study was to investigate the combined effects of an isometric contraction MET with a soft tissue cross-fibre technique on active knee extension (AKE) and passive knee extension (PKE).

10. Emad T.Ahmed, Safa S. Abdelkarim(2013)

Post burn contracture represent a major dilemma facing burn management team especially physical therapist. Several treatment modalities such as stretching, muscle energy technique, and thermotherapy have been utilized to increase the flexibility and regain lost range of motion and function. There is lack of evidence to allow conclusions to be drawn about either muscle energy technique or static stretching technique in increasing the flexibility of hamstring muscle post-burn contracture.

11.Ayala F, (2012)

Reproducibility and criterion – related validity of the sit and reach test and toe touch test for estimating hamstring flexibility in recreationally active young adults.

12. Bruce Duncan, Patrick McHugh, Frank Houghton and Craig Wilson(2011)

Bowen therapy was associated with improvements in neuromuscular function in people with chronic stroke. At this stage of study, it is not possible to conclude that there is definite benefit; however the results suggest that exploration through further research is appropriate.

13.Adel Rashad Ahmed(2011)

The objective of the study was to compare the effectiveness of muscle energy technique and dynamic stretching on hamstring flexibility in healthy male subjects.

14.Mohd. Waseem, Shibili Nuhmani, C. S. Ram(2010)

To compare the effectiveness of Static stretching and Muscleeenergy technique on hamstring flexibility in normal Indian collegiate males.

15. Ahmad Faheem, Ahmad Shamim, Anjani Agarwal, Begum Shabana,(2010)

Success in sports depends on the athlete's ability to develop and perfect a specific set of coordination and joint range of motion, i.e. flexibility. The aim of the study was to investigate and compare the influence of Muscle Energy Technique (MET) and Eccentric Training (ECC) on popliteal angle, i.e. hamstring flexibility in Indian collegiate males.

16.Mohd. Waseem, Shibili Nuhmani and C. S. Ram (2009;)

Success in sports depends on athlete's ability to develop and perfect a specific set of coordination and joint range of motion/flexibility. Purpose of the study to investigate the effectiveness of Muscle Energy Technique (MET) on hamstring flexibility in normal Indian collegiate males.

17. Alonso J, (2009)

Effect of hamstring flexibility on isometric knee flexion angle –torque relationship was shifted to the left in less flexible hamstring such that knee flexion torque was increased at short muscle length and decreased at long muscle length when compared with more flexible hamstring.

18.MadeleineSmithB.^aGaryFryer(2008)

Variations in the application of muscle energy technique (MET) for increasing the extensibility of muscles have been advocated, but little evidence exists to support the relative merit of a particular approach. This study investigated two types of muscle energy techniques that have been advocated in the osteopathic literature that differ primarily in the duration of the post-contraction stretch phase.

19. Smith . M(2007)

A comparison of two MET for increasing flexibility of the hamstring muscle group and the finding suggest that altering the duration of the passive stretch component does not have a significant impact in the efficacy of MET for short term increase in muscle extensibility.

20. Joseph, Lynette Colleen(2005)

An inversion ankle sprain can be defined as an injury caused by landing forcefully on an inverted, plantarflexed and internally rotated foot. This results in the fibres of the surrounding ligaments to become ruptured without disturbing the continuity of the ligament. Chronic stable ankle sprains was defined as the recurrent giving way of the ankle and there may be residual pain and swelling with no mechanical instability. Therefore the purpose of this study was to investigate the relative effectiveness of Muscle Energy Technique compared to Manipulation in the treatment of chronic stable ankle inversion sprains.

21.BSc Fiona Ballantyne(2003)

The aim of the study is to investigate the effectiveness of muscle energy technique in increasing passive knee extension and to explore the mechanism behind any observed change. Muscle energy technique produced an immediate increase in passive knee extension.

22.Michelle Marr(2003)

The effect of Bowen technique on hamstring flexibility over time concluded that a single treatment session with this technique significantly increased the flexibility of the hamstring muscle in asymptomatic individuals and also maintained this level of increase in hamstring flexibility for one week, showing continuing improvements.

23.G fryer, P McLaughlin(2003)

They conducted a study to see the effect of muscle energy technique on hamstring extensibility concluded that there was an immediate increase in the range of motion of knee joint when measured with passive knee extension test following a single application of muscle energy technique.

24. Cheraladhan E. Sambandham, Jagatheesan Alagesan,Shilpi Shah(2002)

The Hamstring muscles are found to be the most prevalent for the tightness in the body. Tightness of these muscles produces decrease range of motion and reduced

flexibility of the pelvis, hip and knee joints. Muscle stiffness of the lower extremities and the consequential decrease in joint flexibility are considered to be major aetiological factors in musculoskeletal injuries. The purpose of this study is to compare the immediate effect of Muscle energy technique and Eccentric training on hamstring tightness of healthy female volunteers.

25. William D. Bandy,C, Jean M. Irion, C, Michelle BrigglerT (2002)

The purpose of this study was to compare the effects of DROM with static stretch on hamstring flexibility. Fifty-eight subjects, ranging in age from 21 to 41 years and with limited hamstring flexibility.

CHAPTER III

MATERIALS AND METHODOLOGY

3.1 MATERIALS

- ✓ Treatment couch.
- ✓ Pillows.
- ✓ Blankets.
- ✓ Goniometer.
- ✓ Inch tape.

3.2 METHODOLOGY

- ✓ Goniometer is used to measure popliteal angle.
- ✓ Inch tape is used to measure sit and reach test value.

3.2.1 POPULATIONS

- ✓ Patients with age group of 18-24 years healthy individual of same sex.

3.2.2 STUDY DESIGN

- ✓ Quasi Experimental Design.
- ✓ Pre and post experimental study design.

3.2.3 STUDY SETTING

- ✓ Nandha college of physiotherapy outpatient department.
- ✓ Nandha mens hostel.

3.2.4 STUDY DURATION

- ✓ Study was conducted for a period of 1-5 days.

3.2.5 TREATMENT DURATION

- ✓ Study was carried out for 1-5 days for each patient.
- ✓ Group A patients received Bowen Technique was performed for in 3 alternate sessions.
- ✓ Group B patients received Muscle Energy Technique was performed for in 3 alternate sessions.

3.2.6 STUDY SAMPLING

- ✓ Convenient Sampling Method.

3.2.7 SAMPLE SIZE

- ✓ Sample size is 30 subjects.
- ✓ Group –A(Bowen technique) 15 patients.
- ✓ Group –B(Muscle Energy Technique) 15 patients.

3.2.8 CRITERIA FOR SELECTION

(a) INCLUSION CRITERIA.

- ✓ Asymptomatic subjects with hamstring tightness.
- ✓ Only males.
- ✓ Age group between 18 to 24 years.
- ✓ 20°-50° degree active knee extension loss with hip in 90 of flexion.
- ✓ Full passive range of motion of knee extension.
- ✓ Subjects willing to participate in the study.

(b) EXCLUSION CRITERIA

- ✓ Subjects having low back pain and neurological pain.
- ✓ Subjects if they have any history of lower extremity injury in past 3 months.
- ✓ Any fracture or surgery done for back, pelvis, hip or knee.
- ✓ Spinal deformity.
- ✓ Any recent abdominal surgery.
- ✓ Any congenital deformities in lower limb.

3.2.9 PARAMETER

GONIOMETER

Goniometer an instrument used to measure the ROM. Goniometer is derived from two Greek word, gonio means angle and meter means measure. The amount of motion that is available at a joint called range of motion. Therefore, goniometry refers to the measurement of angles in particular the measurement of angles created at human joint by the bones of the body.

TYPES

- ✓ Universal Goniometer.
- ✓ Gravity Depending Goniometer.
- ✓ Electro Goniometer.

PROCEDURE

3.2.10 TREATMENT PROCEDURE

- ✓ Subjects were selected by convenient sampling method.
- ✓ 30 subjects who fulfilled inclusion and exclusion criteria were selected by random sampling method, out of them 15 were allotted in Group A and 15 in GroupB.
- ✓ Subjects were clearly explained about the study and written informed consent was obtained from the subjects who fulfilled the criteria.
- ✓ After completing the informed content and they were explained about the scale and the scale was administered.
- ✓ Proper instructions such as purpose, safety measures, comfort, precautions and psychological support were given to the subjects.
- ✓ All vital signs were checked.
- ✓ While doing the assessment, the subject's willingness to continue the procedure with or without rest was given preference.
- ✓ Both Group A and Group B subjects were involved for pre test assessment.
- ✓ Group A underwent Bowen Technique and Group B underwent Muscle Energy Technique.

SIT AND REACH TEST

- ✓ This test involves sitting on the floor with legs stretched out straight ahead.
- ✓ Shoes should be removed and the soles of the feet are placed against the wall.
- ✓ Both knees should be locked and pressed flat to the floor.
- ✓ With the palm facing downward, the subject reaches forward along the measuring line as far as possible. Ensure that the hands remain at the same level.
- ✓ After some practice, the subject reaches out and holds that position for at least one-two seconds while the distance is recorded.



Fig 3.1 Sit and Reach Test.

POPLITEAL ANGLE MEASUREMENT [ACTIVE KNEE EXTENSION]:

- ✓ Subject will be in supine position on the plinth.
- ✓ Subject then flexes hip to 90°.
- ✓ Subject then actively extends each knee in turn.
- ✓ Fulcrum of the Goniometer will be placed over the lateral condyle of the knee joint and popliteal angle is measured.



Fig 3.2. Popliteal Angle Measurement.

BOWEN TECHNIQUE

Patient Position: Subject is lying prone on the plinth.

- ✓ The thumb is placed on top of the designated muscle.
- ✓ Quietly hook the thumb into the lateral edge of the muscle to form a challenge or pressure against the muscle.
- ✓ As we begin to flatten the thumb in a medial direction, the muscle will pluck or plop or respond in some manner.
- ✓ Carry the skin and challenge the muscle.
- ✓ First with the thumbs (left side of the body) followed by the fingers (right side of body). Often the hands are placed on the back with an inch of space between the thumbs and fingers so that the hands can play the muscles simultaneously.
- ✓ Alternate day intervention will be given for 1 week.
- ✓ The treatment time for each session will be 20 minutes.



Fig 3.3 Bowen Technique.

MUSCLE ENERGY TECHNIQUE:

- ✓ Patient Position: Subject is lying supine on the plinth.
- ✓ In this technique, first the subject's knee was extended till the subject feel hamstring tightness.
- ✓ Moderate isometric contraction of the hamstring muscle was given for a period of five seconds.
- ✓ A three second relaxation period was given.
- ✓ This technique will be repeated for three times (for a total of four contractions).
- ✓ Alternate day intervention will be given for 1 week.
- ✓ The treatment time for each session will be 20 minutes.



Fig 3.4 Muscle Energy Technique.

CHAPTER-IV

DATA PRESENTATION AND DATA ANALYSIS

STATISTICAL TOOLS

For the pre and post test experimental study, both paired 't'-test and unpaired 't'- test was used for each parameter to find out the significance of improvement achieved through intervention. Then unpaired 't'-test was used to find out the significance of the changes between two groups.

(a) PAIRED t-TEST

The paired t-test was used to find out the statistical significance between pre and post t-test values of Goniometer and sit and reach test in Group A and Group B.

Formula paired t-test

$$S = \frac{\sum(d-\bar{d})^2}{n-1}$$

$$t = \frac{\bar{d}\sqrt{n}}{s}$$

d = difference between the pre test V_s post test.

\bar{d} = mean difference.

n = total number of subjects.

s = standard deviation.

(b) UNPAIRED t-TEST

The unpaired t- test was used to compare the statistically significance difference of Goniometer and Sit and reach test in Group A and Group B.

Formula unpaired t-test

$$S = \sqrt{\frac{(n_1-1)s_1^2 + (n_2-1)s_2^2}{n_1+n_2-2}}$$

$$t = \frac{|\bar{x}_1 - \bar{x}_2|}{s \sqrt{\frac{1}{n_1} + \frac{1}{n_2}}}$$

n_1	=	Total number of subject in Group- A
n_2	=	Total number of subject in Group- B
X_1	=	Difference between the pre test and post test of Group- A
\bar{X}_1	=	Mean difference between the pre test and post test of Group- A
X_2	=	Difference between pre test and post test of Group- B
\bar{X}_2	=	Mean difference between pre test and post test Group- B
S	=	Standard deviation

DATA PRESENTATION

TABLE-4.1 (a)

**MEAN DIFFERENCE BETWEEN GROUP A AND GROUP B OF RIGHT
AND LEFT IN POPLITEAL ANGLE**

GROUPS	MEAN DIFFERENCE	
	RIGHT	LEFT
GROUP-A (BOWEN TECHNIQUE)	7.73	5.4
GROUP-B (MET)	3.4	3

FIG.4.1 (a)

**MEAN DIFFERENCE BETWEEN GROUP A AND GROUP B OF RIGHT
AND LEFT IN POPLITEAL ANGLE**

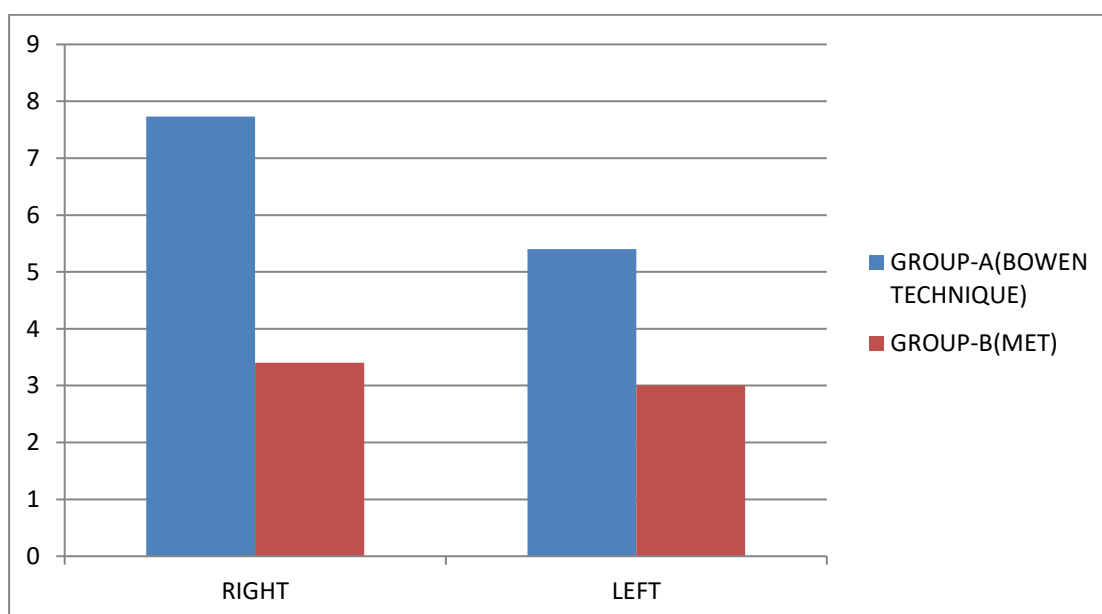


TABLE 4.1 (b)
**MEAN DIFFERENCE BETWEEN GROUP A AND GROUP B OF RIGHT
AND LEFT IN SIT AND REACH TEST**

GROUPS	MEAN DIFFERENCE	
	RIGHT	LEFT
GROUP-A (BOWEN TECHNIQUE)	4.86	4.46
GROUP-B (MET)	2.13	2.06

FIG.4.1 (b)
**MEAN DIFFERENCE BETWEEN GROUP A AND GROUP B OF RIGHT
AND LEFT IN SIT AND REACH TEST**

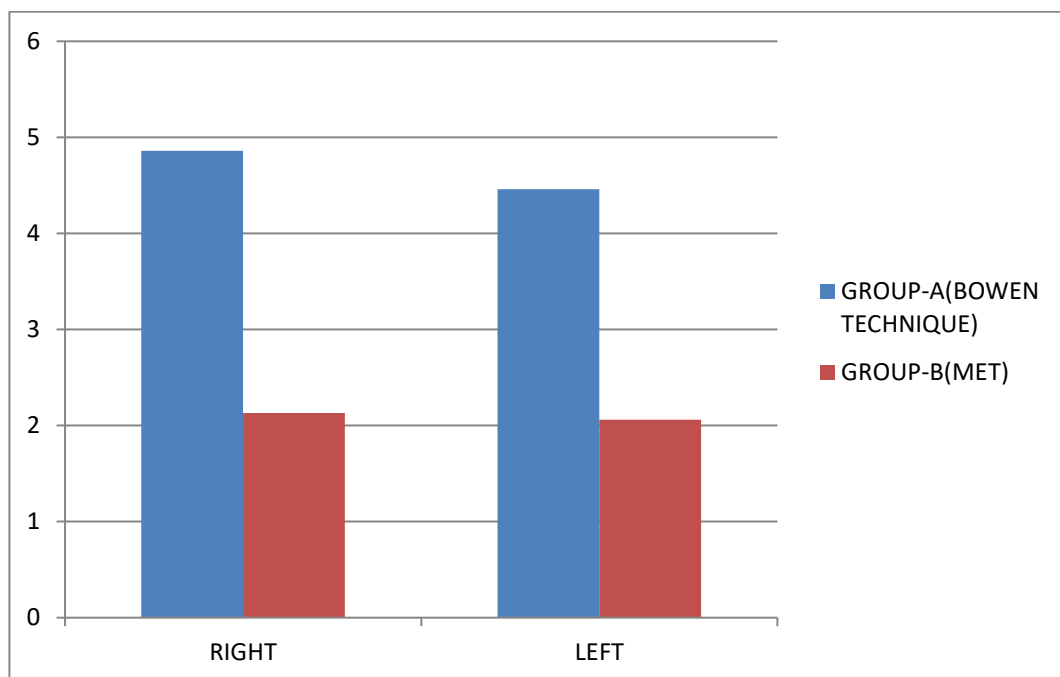


TABLE 4.2 (a)
STANDARED DEVIATION BETWEEN GROUP A AND GROUP B OF
RIGHT AND LEFT IN POPLITEAL ANGLE

GROUPS	MEAN DIFFERENCE	
	RIGHT	LEFT
GROUP-A (BOWEN TECHNIQUE)	2.71	1.91
GROUP-B (MET)	1.47	1.81

FIG-4.2 (a)
STANDARED DEVIATION BETWEEN GROUP A AND GROUP B OF
RIGHT AND LEFT IN POPLITEAL ANKLE

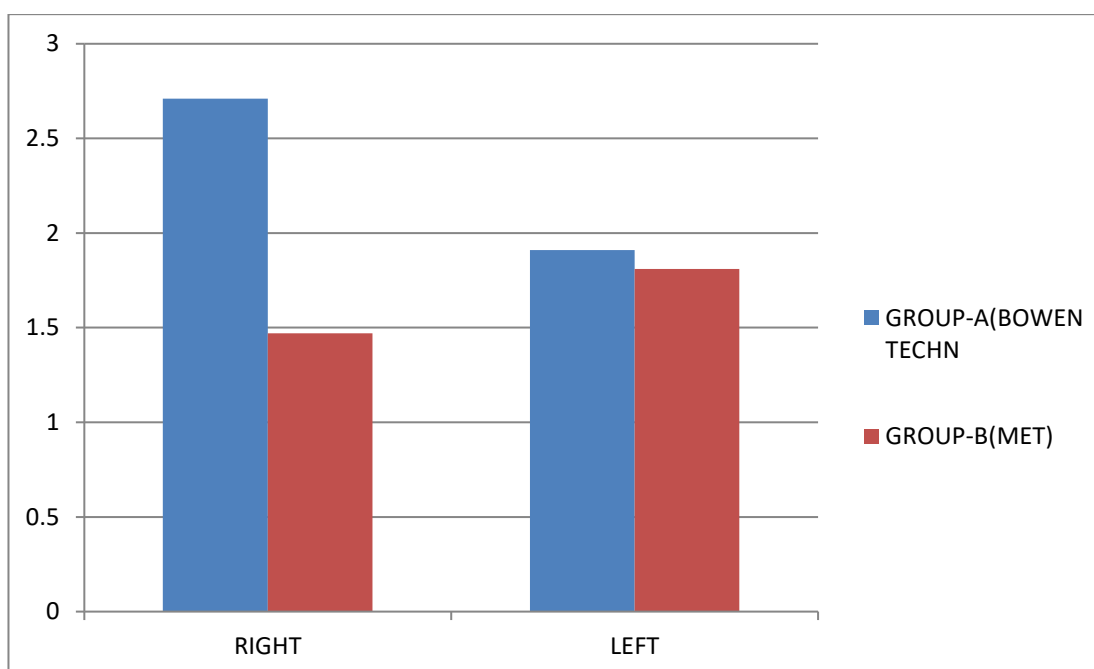


TABLE 4.2 (b)
STANDARED DEVIATION BETWEEN GROUP A AND GROUP B OF
RIGHT AND LEFT IN SIT AND REACH TEST

GROUPS	STANDARED DEVIATION	
	RIGHT	LEFT
GROUP-A (BOWEN TECHNIQUE)	2.01	1.92
GROUP-B (MET)	1.22	1.10

FIG-4.2 (b)
STANDARED DEVIATION BETWEEN GROUP A AND GROUP B OF
RIGHT AND LEFT IN SIT AND REACH TEST

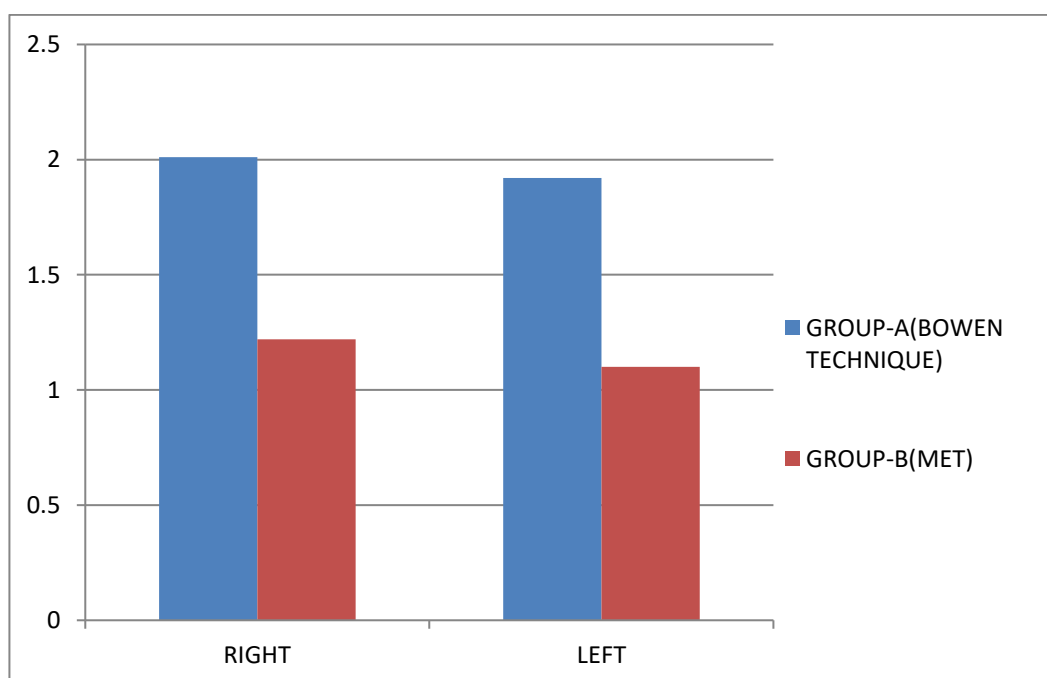


TABLE-4.3 (a)

COMPARISON OF PAIRED 't' TEST AND TABLE VALUE BETWEEN GROUP A AND GROUP-B OF RIGHT AND LEFT SIDE IN POPLITEAL ANGLE

GROUPS	CALCULATED PAIRED 't' VALUE		TABLE VALUE	SIGNIFICANCE
	RIGHT	LEFT		
GROUP A (BOWEN TECHNIQUE)	11.02	10.50	2.15	SIGNIFICANT
GROUP B (MET)	8.90	6.41	2.15	SIGNIFICANT

FIGURE-4.3 (a)

COMPARISON OF PAIRED 't' TEST AND TABLE VALUE BETWEEN GROUP A AND GROUP B OF RIGHT AND LEFT IN POPLITEAL ANGLE

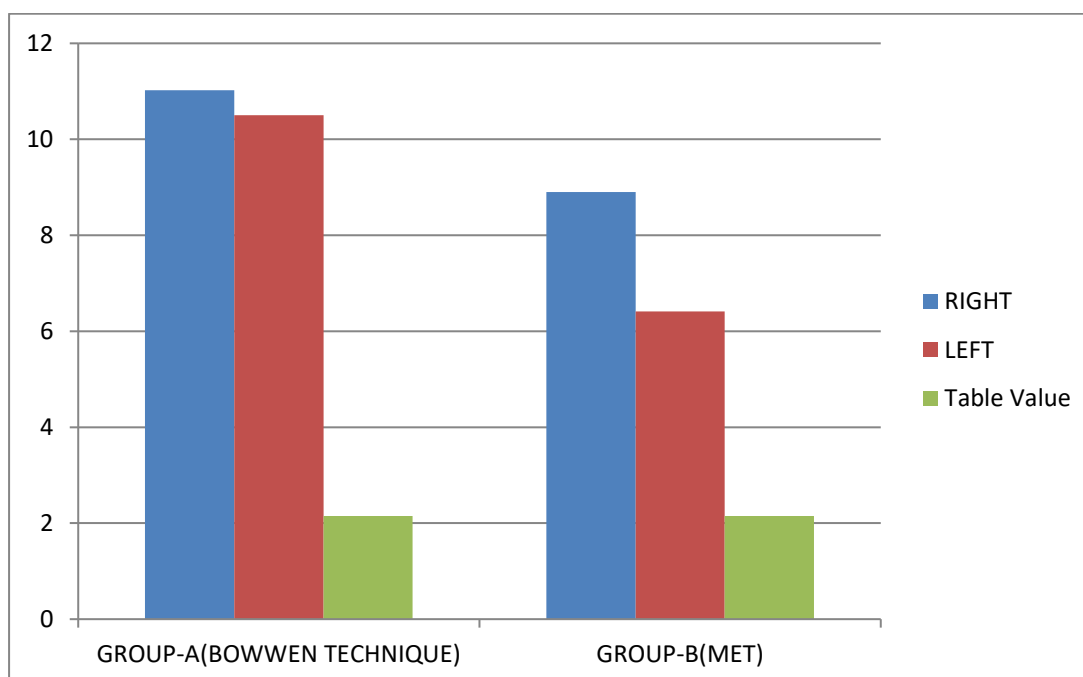


TABLE-4.3 (b)

COMPARISON OF PAIRED 't' TEST AND TABLE VALUE BETWEEN GROUP A AND GROUP-B OF RIGHTAND LEFT SIDE IN SIT AND REACH TEST

GROUP A (BOWEN TECHNIQUE)	CALCULATED PAIRED 't' VALUE		TABLE VALUE	SIGNIFICANCE
	RIGHT	LEFT		
	9.3	8.9	2.15	SIGINIFICANT
GROUP B (MET)	6.7	7.8	2.15	SIGINIFICANT

FIGURE-4.3 (b)

COMPARISON OF PAIRED 't' TEST AND TABLE VALUE BETWEEN GROUP A AND GROUP B OF RIGHT AND LEFT IN SIT AND REACH TEST

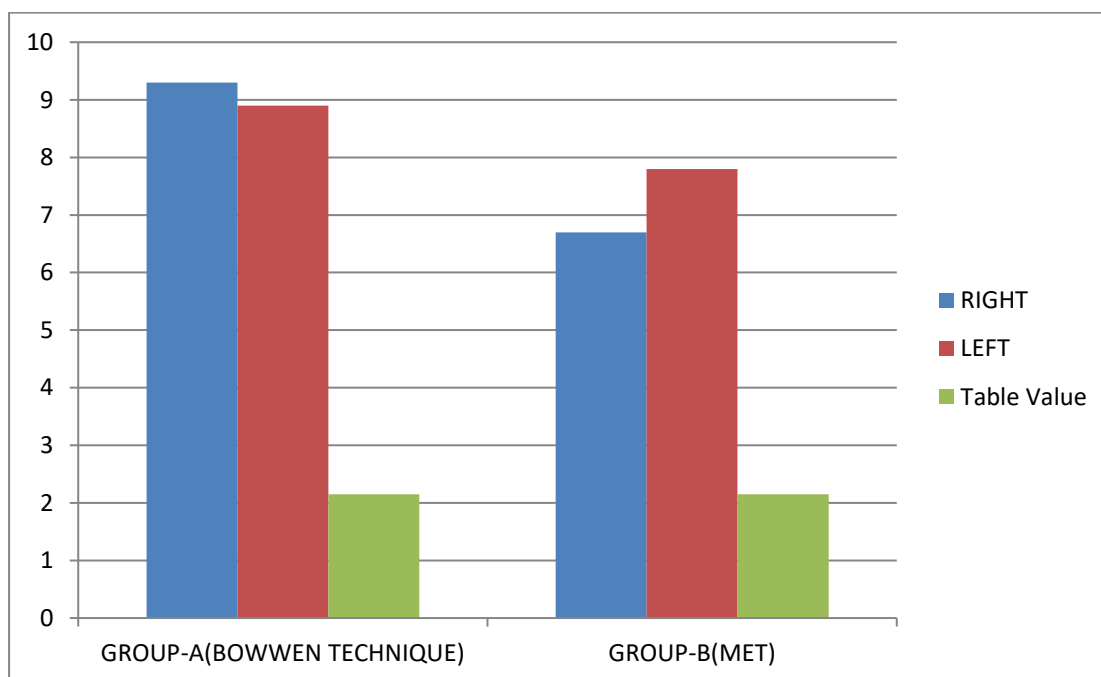


TABLE-4.4 (a)

**COMPARISON OF VALUES OF BOWEN'S & MET ON LEFT AND RIGHT
SIDE UNPAIRED TESTIN POPLITEAL ANGLE**

PARAMETERS	UNPAIRED 't' TEST VALUE	TABLE VALUE	SIGNIFICANCE
GROUP- A(BOWEN TECHNIQUE)	5.72	2.05	SIGNIFICANT
GROUP-B(MET)	3.52	2.05	SIGNIFICANT

FIGURE-4.4 (a)

**COMPARISON OF VALUES OF BOWEN'S & MET ON LEFT AND RIGHT
SIDE UNPAIRED TESTIN POPLITEAL ANKLE**

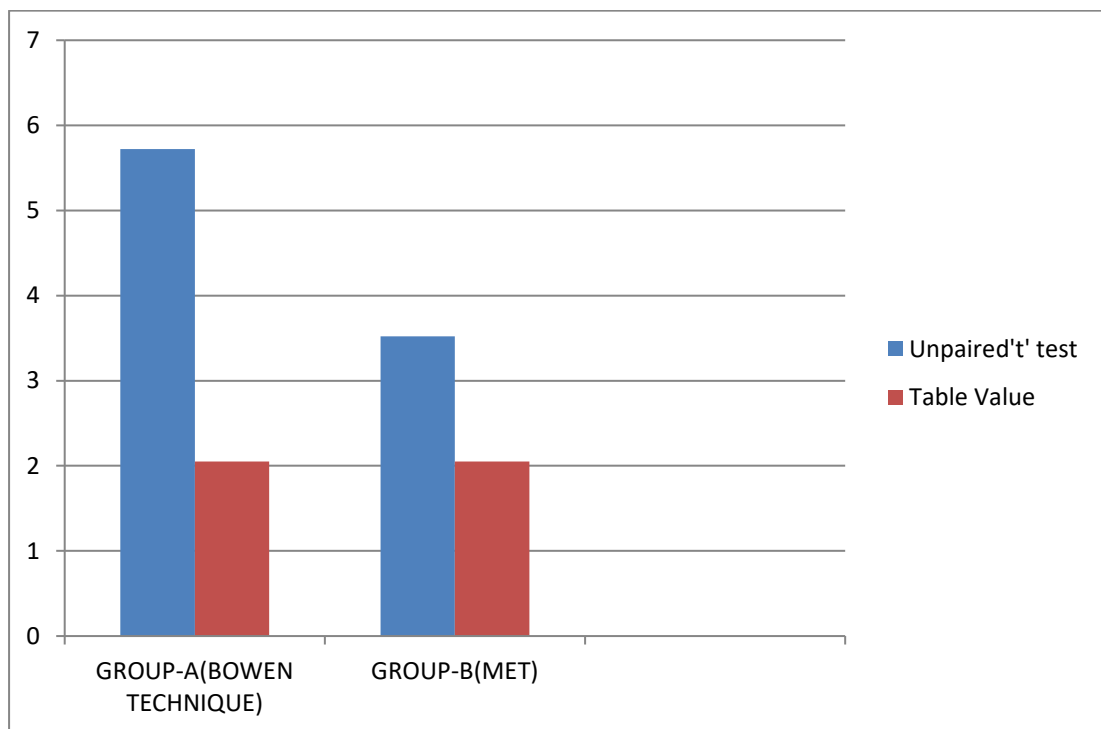


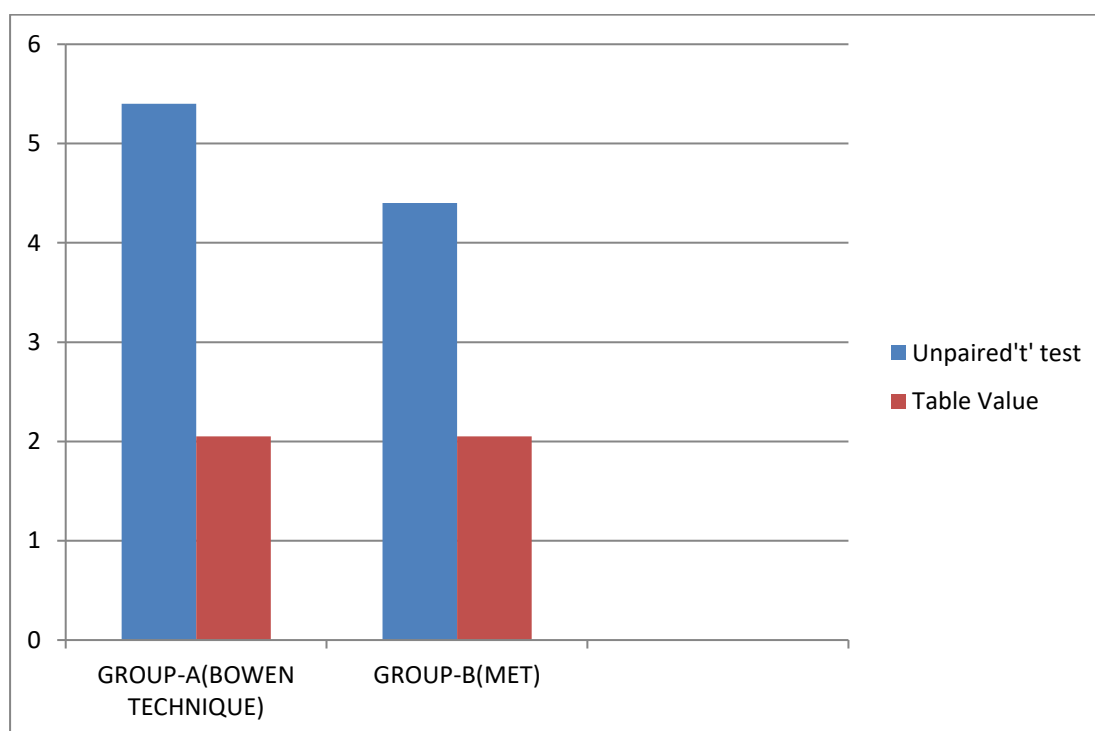
TABLE-4.4 (b)

**COMPARISON OF VALUES OF BOWEN'S & MET ON LEFT AND RIGHT
SIDE UNPAIRED TESTIN SIT AND REACH TEST**

PARAMETERS	UNPAIRED 't' TEST VALUE	TABLE VALUE	SIGNIFICANCE
GROUP- A(BOWEN TECHNIQUE)	5.4	2.05	SIGNIFICANT
GROUP-B(MET)	4.4	2.05	SIGNIFICANT

FIGURE-4.4 (b)

**COMPARISON OF VALUES OF BOWEN'S & MET ON LEFT AND RIGHT
SIDE UNPAIRED TESTIN SIT AND REACH TEST**



CHAPTER-V

RESULTS AND DISCUSSION

5.1 RESULTS

The study sample comprised 30 patients, of which 30 were males. The median time interval of goniometer and sit and reach test applied before and after therapy was 5 days. Among 30 patients, 15 were treated with bowen technique and 15 were treated with Muscle energy technique.

The pre and post test values were assessed in popliteal angle group A. The mean difference value in right side is 7.73 and left side 5.4. The standard deviation value in right side is 2.71 and left side is 1.91. The paired 't' test value for popliteal angle in right side 11.02 and left side 10.50. The paired 't' test value is more than table value 2.15 for 5% level of significance at 14 degrees of freedom.

The pre and post test values were assessed in popliteal angle group B. The mean difference value in right side is 3.4 and left side 3. The standard deviation value in right side 1.47 and left side 1.81. The paired 't' test value for sit and reach test in right side 9.32 and left side 1.9. The paired 't' test value is more than table value 2.15 for 5% level of significance at 14 degrees of freedom.

The pre and post test values were assessed in sit and reach test group B. The mean difference value in right side is 2.13 and left side 2.06. The standard deviation value in right side is 1.22 and left side is 1.10. The paired 't' test value for sit and reach test in right side 6.7 and left side 7.8. The paired 't' test value is more than table value 2.15 for 5% level of significance at 14 degrees of freedom.

The pre and post test values were assessed in sit and reach test group A. The mean difference value in right side is 4.86 and left side 4.46. The standard deviation value in right side 2.01 and left side 1.92. The paired 't' test value for sit and reach test in right side 9.32 and left side 8.97. The paired 't' test value is more than table value 2.15 for 5% level of significance at 14 degrees of freedom.

The calculated 't' values by unpaired 't' test were popliteal angle 5.72 and 3.52 and sit and reach test is 5.42 and 4.48. The calculated 't' values were more than the table value 2.05 for 5% level of significance at 28 degrees of freedom.

The paired 't' test values have shown that bowen technique was more effective than muscle energy technique in asymptomatic patients in hamstring tightness. The unpaired 't' test values have shown that there was significant difference between two groups in showing improvement in their quality of life in patients with hamstring tightness.

5.2 DISCUSSION

The present study was done to compare the effects of Bowen Technique and Muscle Energy Technique (MET) on asymptomatic subjects with hamstring tightness. An alternate day intervention was done for five days (three sessions) to see which technique is more effective in increasing the flexibility of hamstring muscle in terms of popliteal angle and sit and reach test.

There were 15 subjects in each group. The study comprised of subjects aged between 18-24 years in both the groups. Group A and Group B were given three sessions each for alternate days which lasted for a total of five days of treatment sessions.

A study was conducted by Michelle Marr to see effects of Bowen Technique on hamstring flexibility over time. It concluded that a single treatment session with this technique significantly increased the flexibility of the hamstring muscle in asymptomatic individuals and also maintained this level of increase in hamstring flexibility for one week, showing continuing improvements.

After the application of Bowen Technique for three alternate sessions, it showed significant improvements in hamstring flexibility in terms of sit and reach test and increase in range of motion in terms of popliteal angle.

Muscle Energy Technique (MET) is a manual therapy technique, which targets the soft tissue primarily and can be called as Active Muscular Relaxation

Technique. It is a direct active post facilitating technique also known as Post-Isometric Relaxation Technique (PIRT) , which follow different principles individually. It is a procedure in which controlled, voluntary isometric contractions of a target muscle group are widely advocated. It is effective for lengthening of shortened muscles, strengthening the muscle as lymphatic or venous pump to help drainage of fluids and for increasing range of motion (ROM). After Muscle Energy Technique there is viscoelastic change in muscle which helps in increasing muscle flexibility. After the application of muscle energy technique for three sessions alternately our study also showed significant improvement in the flexibility of hamstrings when measure with sit and reach test, increase in the range of motion was seen in the active knee extension test and significant increase was seen in the strength of the hamstring muscle.

Hence our study concluded that when Bowen Technique and Muscle Energy Technique are compared they both are equally effective in increasing the flexibility, range of motion and strength of the hamstring muscle when delivered for three sessions alternately.

It also concluded that Bowen Technique proved to be a little more effective than Muscle Energy Technique in terms of increase in the range of motion as it was a passive technique and the muscle was relaxed completely because of the moves and deep pressure applied by the therapist. But on the other hand, MET proved to be significantly effective in increasing the strength of the hamstring muscle because this technique was an active technique and the subject had to actively participate and apply his own strength against the therapist.

As per our knowledge, this is the first study which compared the effects of Bowen Technique and Muscle Energy Technique (MET) on hamstring tightness in healthy individuals with alternate three session intervention. Hence both the techniques can be used clinically to increase the flexibility and strength of the hamstring muscle.

5.3 LIMITATIONS

- The study has been conducted on small size sample only.
- This study took shorter duration to complete.
- Age group taken for the study was limited (18-24 years).

5.4 RECOMMENDATIONS

- A similar study may be extended with larger sample.
- The future study can be compared with various techniques also.
- The Bowen Technique and Muscle Energy Technique can be applied to other muscles also.

CHAPTER VI

CONCLUSION

On the basis of statistical analysis, we conclude that 3 sessions on alternate days for a week proved to be effective in improving popliteal angle, sit and reach test for flexibility and strength of muscle in both Bowen Technique as well as Muscle Energy Technique but Bowen Technique has shown more improvement in hamstring flexibility and ROM than Muscle Energy Technique. Increase in strength was seen more in Muscle Energy Technique than the Bowen technique. Since this study has given a better result in normal subjects it can be recommended for the use of the patients with hamstring tightness. This study analyses the immediate effect of hamstring flexibility, so the maintenance of flexibility of hamstring muscle for long term can be done as a further study. These techniques can also be used for athletic population. Since this study recruited small number of subjects, the number of subjects can be increased in further studies.

CHAPTER VII

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CHAPTER VIII

APPENDIX-I

ASSESSMENT FORM

Name :

Age :

Gender :

Occupation :

Address :

CHIEF COMPLAINTS

Present history

- ✓ Mode on set
- ✓ Duration
- ✓ Associate problem

Past medical history

- ✓ Birth history
- ✓ History of other diseases and injuries
- ✓ Operation & hospitalization
- ✓ Medications
- ✓ Physiotherapy treatment

Personal history

- ✓ Personal habits

Family history

- ✓ Similar problem in relatives
- ✓ Hereditary disease
- ✓ Infections
- ✓ Socio –Economic status

VITAL SIGNS

- ✓ Heart rate
- ✓ Respiratory rate

- ✓ Blood pressure
- ✓ Temperature

PAIN

- ✓ Nature:
- ✓ Mode of onset:
- ✓ Course (If Radiates):
- ✓ Aggravating Factors:
- ✓ Relieving Factors:
- ✓ Visual Analogue Scale

GENERAL OBSERVATION

- ✓ Body Built:
- ✓ Posture :
- ✓ Gait :
- ✓ Deformities:

LOCAL OBSERVATION

Inflammation :
 Swelling :
 Scar :
 Skin condition :
 Muscle Wasting:
 Shape Alternation:

PALPATION:

- ✓ Swelling: Pitting, Non pitting
- ✓ Tenderness: GradeI/GradeII/GradeIII/GradeIV
- ✓ Warmth
- ✓ Crepitus
- ✓ Scar : Heal/Non-Heal/Length

ON EXAMINATION

POPLITEAL ANKLE:

SIT AND REACH TEST:

SENSORY EXAMINATION:

SUPERFICIAL SENSATIONS:

Touch:

- ✓ Normal
- ✓ Anesthesia
- ✓ Hyperesthesia
- ✓ Hypoesthesia

DEEP SENSATIONS:

SUPERFICIAL REFLEXES:

DEEP TENDON REFLEXES:

INVESTIGATIONS:

- ✓ Pathological Findings
- ✓ Radiological Findings

SPECIAL TESTS

DIFFERENTIAL DIAGNOSIS

DIAGNOSIS

PHYSIOTHERAPY AIMS

SHORT TERM GOALS

LONG TERM GOALS

PHYSIOTHERAPY PLAN

HOME EXERCISE PROGRAM

ERGONOMICS

INSTRUCTIONS BY THERAPIST

DATE OF EVALUATION

APPENDIX –II
ETHICAL CLEARANCE

Ethically permission for the study will be obtained from the subjects and a written consent will be taken from each subject who participates in the study, As this study involve human subjects the Ethical Clearance has been obtained from the Ethical committee of Nandha College Of Physiotherapy, Erode as per the ethical guidelines for Bio-medical research on human subjects, 2000 ICMR, (Indian council of Medical Research) New Delhi.

Written Informed Consent Form

**NANDHA COLLEGE OF PHYSIOTHERAPY,
ERODE.**

Informed consent form for the volunteers at “Nandha College of Physiotherapy, Erode”, who will be participating in the research project entitled **“EFFECT OF BOWEN TECHNIQUE VERSUS MUSCLE ENERGY TECHNIQUE ON ASYMPTOMATIC SUBJECTS WITH HAMSTRING TIGHTNESS”**.

Name of Principal Investigator	Reg. No.271650081 Post graduate student
Name of Organization	Department of physiotherapy in sports, Nandha College of Physiotherapy, Erode

This Informed Consent Form has two parts:

Information Sheet (to share information about the research with you)

Certificate of consent (for signatures if you agree to take part)

You will be given a copy of the full Informed Consent Form

PART I: Information Sheet

Introduction

I ----- , postgraduate student in the physiotherapy department of neurology, Nandha College Of Physiotherapy, Erode, am working on my dissertation titled **“EFFECT OF BOWEN TECHNIQUE VERSUS MUSCLE ENERGY TECHNIQUE ON ASYMPTOMATIC SUBJECTS WITH HAMSTRING TIGHTNESS”**.

I am going to give you information and invite you to be part of this research. You do not have to decide today whether or not you will participate in the research. Before you decide, you can talk to anyone you feel comfortable with about the research.

There may be some words that you do not understand. Please ask me to stop as we go through the information and I will take time to explain. If you have questions later, you can ask them and get yourself clarified.

Purpose of research

Type of Research Intervention

In this study if you are selected, detailed history taking, clinical examination and routine investigation will be done.

Participant selection

Study group: Adult between age group of 18-24 years with fatigue related hamstring tightness will be recruited in study group after obtaining the informed consent. After explaining the procedure all the patients will be divided into two study groups each study group consisting at least 15 patients. First study group will be treated with Bowen Technique Second study group with Muscle Energy Technique Evaluation of outcome will be done for each study Group at the end of Second week. The data will be analyzed statistically.

Duration: 5 days.

Voluntary participation

Your participation in this research is entirely voluntary. It is your choice whether you choose to participate or not, it will not affect our patient's treatment process

Benefits

Personally you might be or may not be benefited in any way directly from the research. But by taking part in this research, you will be helping the scientific community.

Possible risks

There are no major physical risks for the person associated with these methods. Complications include exacerbation of symptoms after maneuver which is rare possibility

Reimbursements

You won't be given any monetary incentives or gifts for being a part of this research

Confidentially

The information that we collect from this research project will be kept confidential. Information about the patient that will be collected during the research will be put away and no-one but the research will be able to see it.

Right to Refuse or Withdraw

You do not have to take part in this research if you do not wish to do so. You may also stop participating in the research at any time you choose. It is your choice and all of your rights will still be respected.

Who to Contact

This proposal has been reviewed and approved by the Research and Ethical committee of Nandha College of Physiotherapy, Erode, which is a committee whose task it is to make sure that research participants are protected from harm

You can ask me any more questions about any part of the research study, if you wish to. Do you have any questions?

PART II: Certificate of consent

I have read the foregoing information, or it has been read to me. I have been explained the procedure and complication. I am willing to participate in the study. I have had the opportunity to ask questions about it and any questions that I have asked have been answered to my satisfaction. I consent voluntarily to participate as a participant in this research

Name of the participant _____

Signature of participant _____

Date _____

Day/month/year

If illiterate witness must sign (if possible, this person should be selected by the participant and should have no connection to the research team). Participants who are illiterate should include their thumb-print as well.

I have witnessed the accurate reading of the consent form to the potential participant, and the individual has had the opportunity to ask questions. I confirm that the individual has given consent freely

Name of witness _____

Thumb print of participant

Signature of witness _____

Date _____

Name of Researcher/person taking the consent _____

Signature of Researcher/person taking the consent _____

Date-----

Day/month/year

APPENDIX-III

DATA PRESENTATION

S.NO	POPLITEAL ANGLE							
	BOWEN'S TECHNIQUE				MET			
	RIGHT		LEFT		RIGHT		LEFT	
	PRE	POST	PRE	POST	PRE	POST	PRE	POST
1	35	34	35	42	28	32	28	30
2	38	44	37	41	28	32	25	31
3	40	48	41	42	28	32	27	31
4	36	44	35	43	26	32	25	29
5	38	42	37	41	28	30	29	31
6	34	48	33	42	30	34	29	33
7	36	42	35	40	28	34	28	30
8	38	46	39	45	28	32	27	31
9	40	46	37	43	30	36	29	35
10	38	44	35	41	28	32	25	30
11	36	42	39	44	28	30	28	32
12	40	48	34	40	28	30	27	28
13	34	48	36	43	28	30	29	30
14	36	44	42	47	30	32	28	29

15	42	48	43	46	28	30	28	29
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DATA PRESENTATION

S.NO	SIT AND REACH TEST							
	BOWENS TECHNIQUE				MET			
	RIGHT		LEFT		RIGHT		LEFT	
	PRE	POST	PRE	POST	PRE	POST	PRE	POST
1	8	15	10	12	10	12	8	14
2	7	14	12	14	12	14	14	15
3	8	15	13	15	13	15	9	13
4	8	10	15	16	15	16	7	13
5	15	16	13	15	13	15	7	12
6	14	15	14	15	14	15	6	13
7	10	15	13	15	13	5	7	14
8	14	17	9	11	9	11	14	15
9	8	13	8	10	8	10	10	14
10	7	12	10	13	10	13	14	17
11	5	10	9	12	9	12	8	13
12	8	13	7	10	7	10	14	17
13	7	12	6	9	6	9	5	10
14	8	14	15	16	15	16	7	12
15	14	17	14	17	14	17	8	13

APPENDIX - IV

ABSTRACT

Aim: The Aim of this study is to compare “EFFECT OF BOWEN TECHNIQUE VERSUS MUSCLE ENERGY TECHNIQUE ON ASYMPTOMATIC SUBJECTS WITH HAMSTRING TIGHTNESS”

Materials and Methods: A Quasi Experimental study design consisting of reviews of charts of HAMSTRING TIGHTNESS patients. Thirty patients were included, (50%) were males, (50%) were females ; the average age was 18-24 years. All the patients are presented with HAMSTRING TIGHTNESS underwent GONIOMETER AND SIT AND REACH test. Pre- and post-Treatment of Group A patients received (Bowen technique) and Group B patients received (Muscle energy technique) scores on the improve range of motion strength of muscle and physical functional of the goniometer and sit and reach test were analyzed.

Results: The pre and post test values were assessed by BOWEN TECHNIQUE and MUSCLE ENERGY TECHNIQUE in Group A and Group B. The calculated t values by unpaired t test were in group A is **5.72** and Group B is **3.52**. The calculated t values were more than the table value **2.05** for **5%** level of significance at **28** degrees of freedom.

Conclusion: In the present sample, Bowen technique had a positive and significant effect on the improve range of motion strength of muscle and physical functional of the goniometer and sit and reach test before and after therapy.

Keywords: Bowen technique, Muscle energy technique, Goniometer, Sit and reach test.